Revue suisse de Zoologie 112 (2): 439-455; juin 2005

Trojanella serbica gen. n., sp. n., a remarkable new troglobitic travunioid (Opiliones, Laniatores, Travunioidea)

Ivo M. KARAMAN
Department of Biology and Ecology, Faculty of Sciences, Trg D. Obradovića 2, 21000 Novi Sad, Serbia and Montenegro.
E-mail: karaman@ib.ns.ac.yu

***Trojanella serbica* gen. n., sp. n., a remarkable new troglobitic travunioid (Opiliones, Laniatores, Travunioidea). -** A new species of travunioid from Serbia, Mt. Stara Planina, is described and a new genus is established. The new species exhibits some characters and combination of characters not known from any other species. It cannot be placed at this time in any of the described families of the superfamily Travunioidea. Some unknown details of male morphology in *Abasola hofferi* (Travuniidae) are presented.

Keywords: Travunioidea - Mt. Stara Planina - troglobite - Travuniidae - *Abasola hofferi* - penis structure.

INTRODUCTION

Thanks to intensive biospeleological research done by the Belgrade Institute for Protection of Nature team under Dragan Pavicević's leadership, an unusual new species of troglobitic opilionid has been discovered. Specimens of the new species were found in a pothole in Mt. Stara Planina in south-east Serbia, near the Bulgarian border. The specimens were collected from the 60 m deep pothole, between stones of the breakdown covering its bottom.

The new species belongs to the suborder Laniatores and the superfamily Travunioidea which is widespread in temperate zones of both hemispheres. In the southern hemisphere this superfamily has a typical Gondwanan distribution, whereas in the northern hemisphere it is represented by a small number of genera and species found locally in some parts of Europe, North America, Japan, and Korea. In all areas, representatives of this superfamily mostly occur as rare relict elements, often as troglobionts, which indicates the great age of the group.

Characteristics of the new species and the combination of characteristics make the species unique in the group. So it was not difficult to establish that it belongs to a new genus. On the basis of the criteria of significance of certain characters and of the current classification of the Travunioidea into families and subfamilies, the position of this new genus is rather disputable. By its sternum structure, form of spiracle and the type of claws structure, this genus seems closely related to the family Triaenonychidae, which representatives are predominantly distributed in the southern hemisphere (in the

Manuscript accepted 01.12.2004

northern hemisphere, given the current composition, this family is represented by 12 genera and 23 species in North America, Japan and Korea). On the other hand by the ovipositor morphology and midgut anatomy this new genus is closely related to the north hemispheric families Cladonychidae and Travuniidae.

Systematic of the superfamily Travunioidea is somewhat confusing with five families and eight subfamilies, in some cases uncritically erected. A comprehensive revision of the whole superfamily Travunioidea is needed. Recent confusing systematic of the superfamily, the extremely specific penis structure and combination of relevant characters of *Trojanella serbica* gen. sp. n., made me decide to put it in Travunioidea *incertae sedis*.

Male specimens of *Abasola hofferi* Šilhavý, 1936 (family Travuniidae) were first collected in the cave Pokljuka Gornja (type locality) in Montenegro (Šilhavý, 1936). The material was used for comparison and for learning more about the morphology of this little known species. Details of penis structure in *A. hofferi* question the validity of the current composition of the Travuniidae.

RESULTS

Travunioidea *incertae sedis*

Trojanella gen. n.

The genus of small long legged Travunioidea is defined by morphological characters of the genitalia. Penis with elongated truncus and movable articulated, flattened, bifurcate glans. Truncus of the penis terminally widened; musculature settled in the terminally widened part of the truncus and in the glans. Glans wide and flattened, terminally bifurcated, laterally with 2 strong teeth-like protrusions. Ovipositor with 4 lobes terminally; dorsal and ventral one as well as the ovipositor body covered with sparce denticles; lateral lobes smooth, each bearing ventral and dorsal rows of few spines.

Spiracle not concealed, semicircular in shape. Sternum narrow, basally widened with setae; subapically trapezoidally expanded.

Claws III and IV with a pair of elongated, flattened branches parallel to widely flattened medial prong. Shape of these claws similar to peltonychium in Travuniidae. Juveniles with claws III and IV of peltonychium type.

Type species. *Trojanella serbica* sp. n.

Etymology: *Trojan* – in south Slavic mythology the demon or the god of night and darkness. According to legends, most often lives in ruins of towns and fortresses. The name is diminutive of femine gender.

Trojanella serbica sp. n. Figs 1-4, 5A, 6-7

Material examined: From an unnamed pothole, at the locality of Vladikina Ploča in the Visočica River gorge, near the village of Rsovci, on Mt. Stara Planina, Serbia (Serbia & Montenegro), 900 m asl (UTM - FN48), 2.10.2002. leg. I.Karaman: 1 ♂ holotype, 5 ♂ paratypes, 8 ♀ paratypes and 2 juv. (+1 adult specimen used for molecular analyses); *ibid.*, 30.05.2002, leg. S. Ognjenović: 2 juv.; *ibid.*, 2.10.2002-2.06. 2003, from traps. leg. S. Ognjenović: 3 ♂ paratypes and 3 ♀ paratypes.

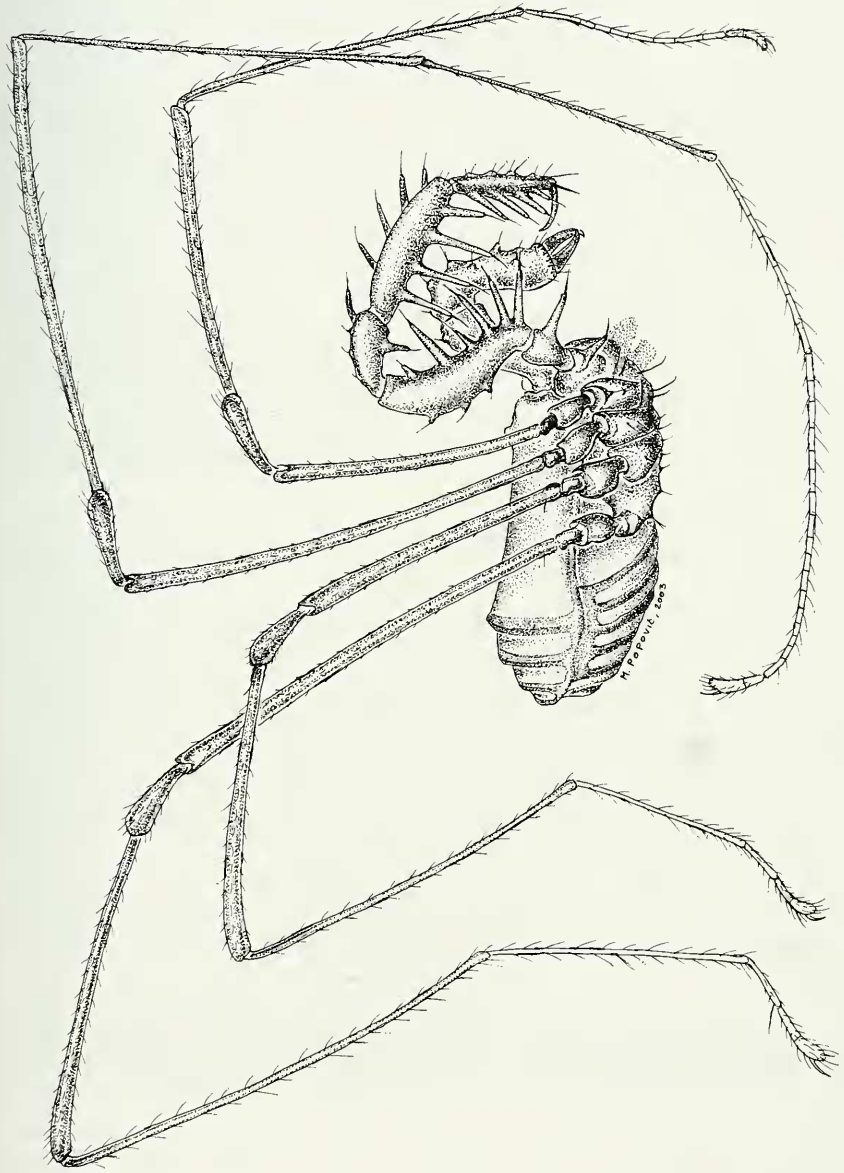

FIG. 1. *Trojanella serbica* gen. n., sp. n. (male paratype, 1.83 mm): Lateral view.

Holotype ♂ (Inv.No 1324), 7 ♂, 10 ♀ paratypes and 4 juv. are deposited in the author's collection at the Department of Biology and Ecology – Novi Sad (Serbia & Montenegro), 1 ♂ and 1 ♀ paratypes in the Muséum d'histoire naturelle, Geneva, Switzerland.

Description

Male: Blind troglobitic species. Male holotype 1.7 mm (male paratypes 1.58-1.83 mm) long, measured from frontal edge of dorsal scutum. Body uniformly yellowish amber in colour. Dorsum densely granular with sparse rows of setae and pronounced lateral grooves in its median area (Figs 2A-B). Grooves starting with two lateral creases on both sides of carapace region on same level as ocular tubercle and above ozopores. Creases joined in a depression at posterior end of dorsal scutum. A pair of grooves anteriolateral, near and parallel to frontal edge of dorsal scutum. Conical ocular tubercle distant from anterior edge of dorsal scutum for almost twice its length.

Coxal lobes II anteriomesally with strong conical apophyses (male secondary sexual character) ventrally directed (Fig. 2C), sparsely setose. Coxal lobes III anteriomesally with a pair of small tubercles (on both sides of the sternal subapical expansion). Sternum as in Fig. 2C, basally widened, with two pairs of setae (short and long ones); sternum slightly trapezoidally expanded at level of junction between coxae II and III.

Chelicerae (Figs 3A-B). Basal segment gradually widened distally, dorsal surface terminally with two tubercles bearing setae, ventrally with few setae; second segment anteromesally with two spinelike tubercles bearing subapical setae, anteriorly with several tubercles bearing apical setae and with concentration of terminal setae.

Pedipalps (Figs 3C-D) in a form of catching basket, armed with strong elongate spinelike tubercles, each bearing a strong elongate seta subapically; coxae ventrally with a low tubercle bearing small setae and a strong spinelike tubercle proximally; trochanter ventrally with 1 strong spinelike tubercle, dorsally with 1 tubercle bearing small setae; femur strong, ventrally with a row of 6 spinelike tubercles (proximal 3 stronger than others), medio-proximally with 2 spinelike tubercles, dorsally with 2 low spinelike tubercles; patella medially with 2 spinelike tubercles, laterally with 1 spinelike tubercle; tarsus with 4 strong spinelike tubercles on both sides (laterally and medially), terminally with 2 strong setae. Claw elongated. All articles bearing sparce hairs and setae, on dorsal sides usually placed on low tubercles. Sparce hairs on tarsal segment in longitudinal rows.

Legs elongated, segments cylindrical; coxae ventrally with a row of tubercles bearing setae subapically; each femur basally with a false articulation (Fig. 7B). Calcanei I-IV elongated. Ratio of calcaneus/astragalus of metatarsi I-IV: 0.78/0.91/1.08/1.56. Tarsal formula: I-11; II-24; III-3; IV-3.

Tarsal claws of first and second legs simple (Fig. 4A), first claw somewhat more sickle-shaped than second one; claws of third and fourth legs (Figs 4C-D) with lateral branches almost parallel to longer median prong, median prong and basal parts of branches dorso-ventrally flattened.

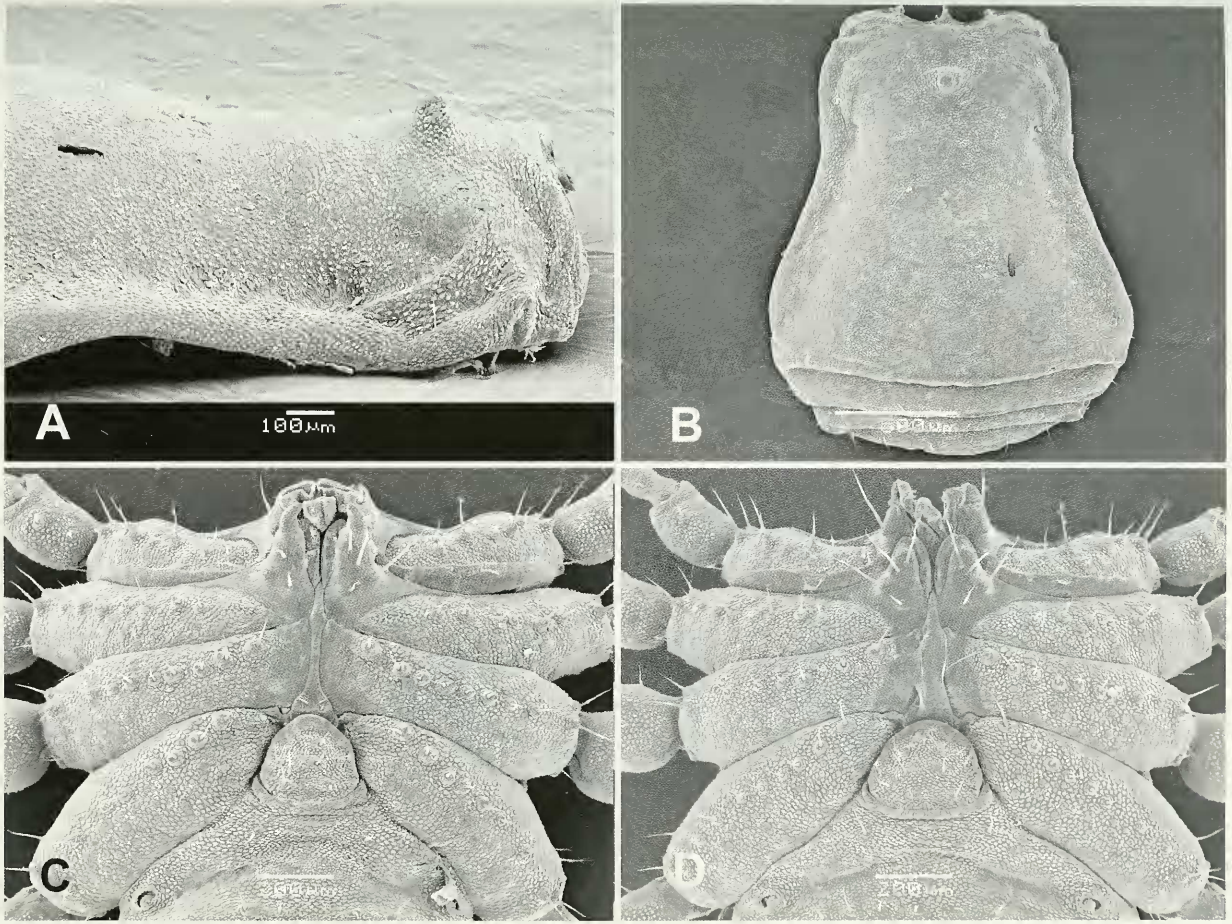

FIG. 2
Trojanella serbica gen. n., sp. n. (male paratype, 1.76 mm): **A**, anterior part of dorsal scutum, lateral view; **B**, dorsum, dorsal view; **C**, anterior part of body, ventral view. *T. serbica* gen. n., sp. n. (female paratype, 1.68 mm): **D**, anterior part of body, ventral view.

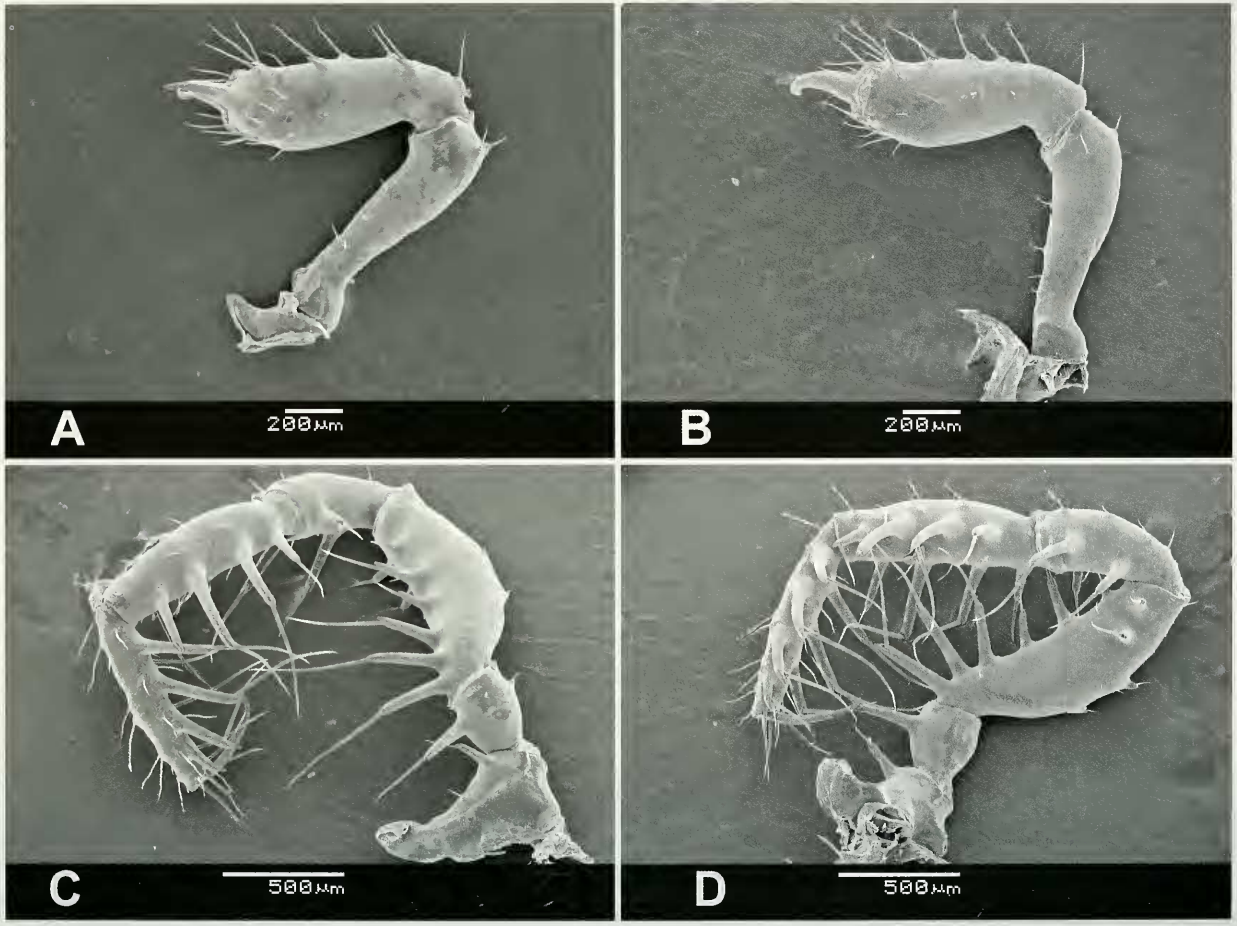

FIG. 3
Trojanella serbica gen. n., sp. n. (male paratype, 1.76 mm): **A**, chelicera, inner view; **B**, chelicera, outer view; **C**, pedipalp, outer view; **D**, pedipalp, inner view.

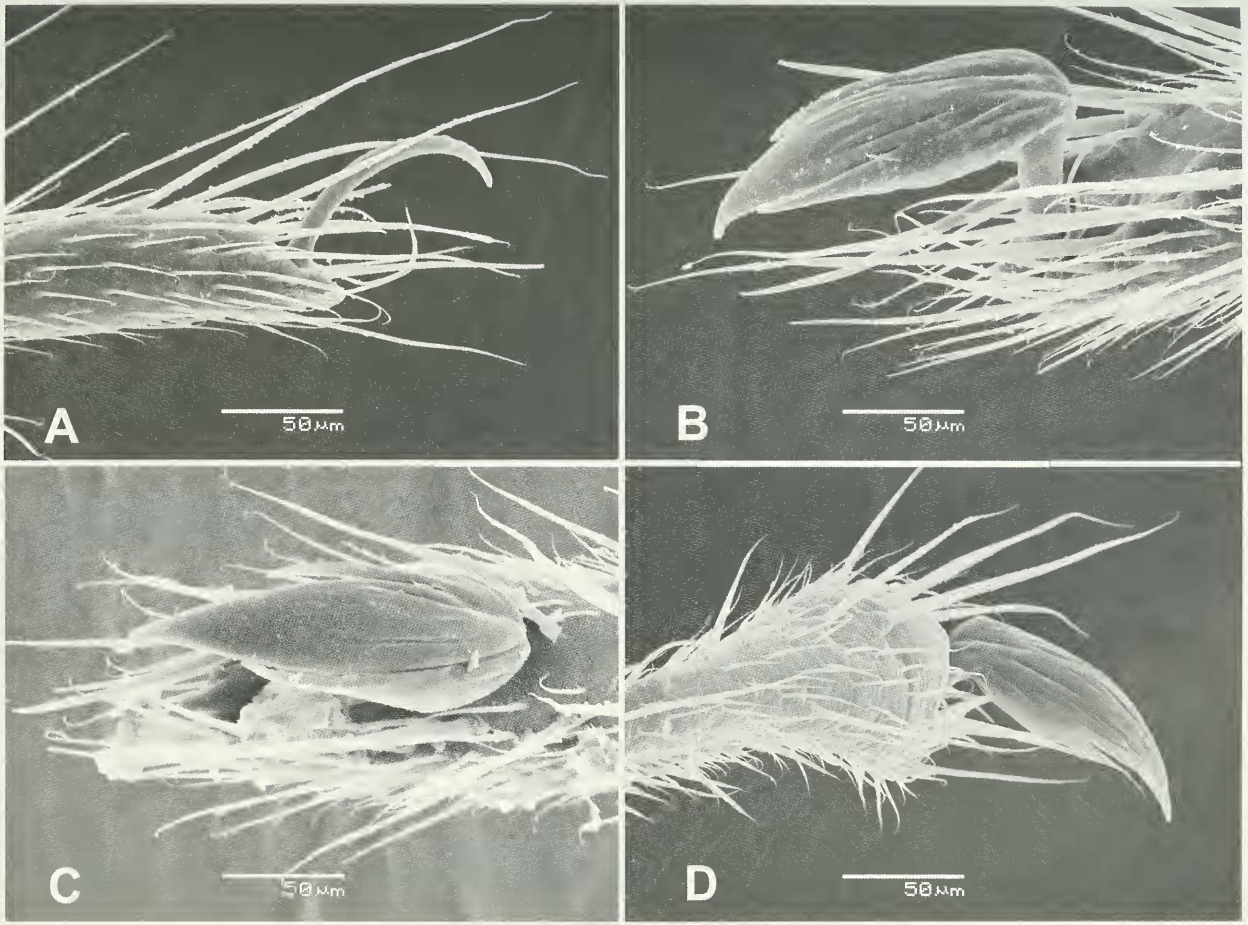

FIG. 4
Trojanella serbica gen. n., sp. n. (male paratype, 1.76 mm): **A**, claw I; **B**, claw III; **C**, claw IV; *T. serbica* gen. n., sp. n. juvenile: **D**, claw IV.

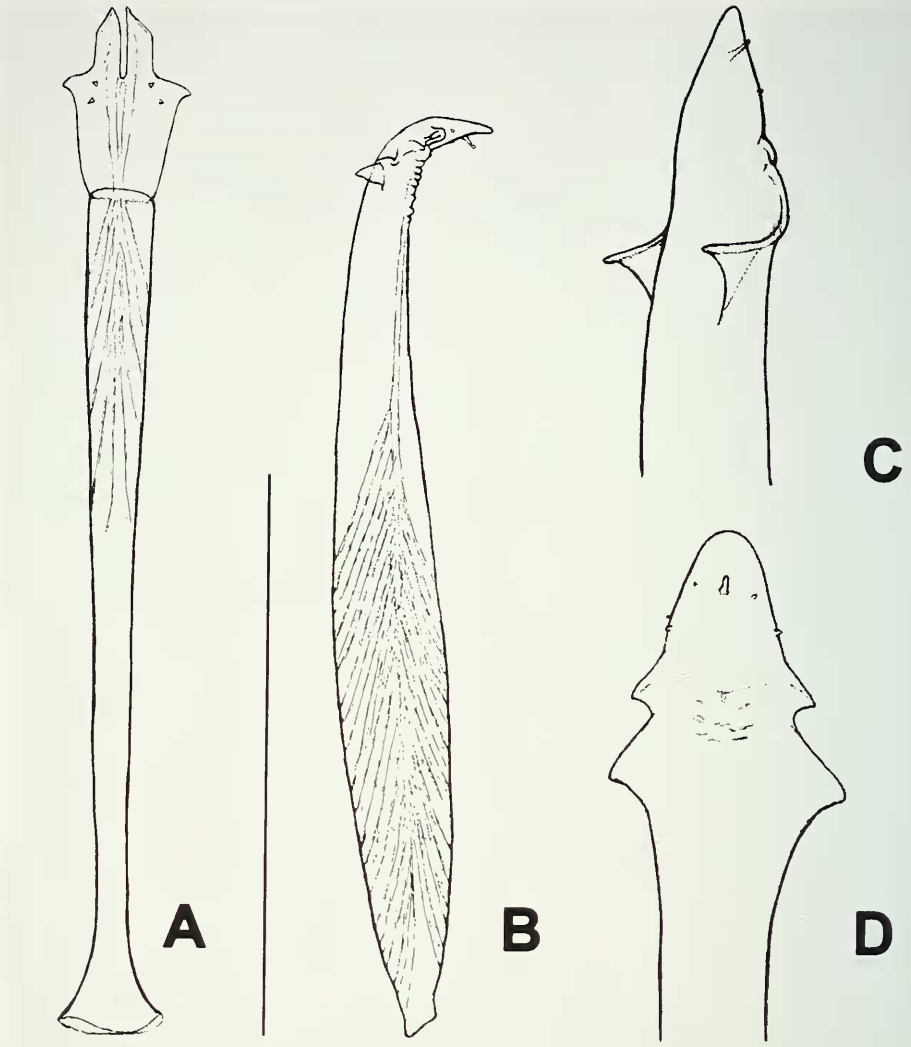

FIG. 5

Trojanella serbica gen. n., sp. n. (holotype): **A**, penis, ventral view. *Abasola hofferi* (male, 1.23 mm): **B**, penis (contracted), lateral view. *A. hofferi* (male, 1.43 mm): **C**, terminal part of penis, lateral view; **D**, penis terminal part, ventral view. Scale line: **A, B** = 500μ; **C, D** = 100μ.

Measurements of legs (in mm):

	Tr	*Fe*	*Pa*	*Ti*	*Mt*	*Ta*	Σ
Leg I	0.31	2.16	0.5	1.93	1.82	2.38	9.1
Leg II	0.36	3.44	0.7	3.22	3.19	4.9	15.81
Leg III	0.42	2.58	0.56	1.96	2.66	2.24	10.42
Leg IV	0.39	3.22	0.56	2.4	3.16	3.22	12.95

Penis (Fig. 5A; Figs 6A-D). Truncus elongated with wide basis, from the basal narrowing gradually widened toward the apex; musculature concentrated in distal part of truncus and in glans. Glans wide and flattened, terminally bifurcated, laterally with a pair of divergent tooth-like protrusions, ventrally with 2 pairs of short spines. Seminal opening situated in between branches of glans bifurcation, close to its ventral side (Fig. 6C, see arrow). Glans musculature composed of a median trapezoidal muscle extending through entire length of glans to apical parts of bifurcation (on inner side of each branch), and by smaller muscle bands situated on outer sides of bifurcation branches. Inner structure of glans complex, with 2 groups of cells (possibly glandular structures) lateral to trapezoidal muscle. This group of cells extended from terminal parts of truncus to level of lateral teeth-like protrusions. If these structures really represent glands, their canals could open on the tips of the bifurcation branches. Unfortunately the tiny membranous structures at the tip of the bifurcations as seen at high magnification under LM and SEM (Fig. 6D) does not allow me to reach a conclusion about the presence of glandular openings on them.*

Female: Similar to male in somatic characters but differs in lacking the medial conical apophyses on coxal lobes II. Genital operculum wider than in male (Fig. 2D). Body length (from frontal edge of dorsum) 1.54-1.91 mm. Ovipositor cylindrical, with 4 terminal lobes (Fig. 7A); ovipositor body and outer sides of dorsal and ventral lobes covered with sparse denticles; lateral lobes smooth, on the ventral side bearing 3 small spines, on the dorsal side 4-5 small spines; eight spherical receptacles in radial arrangement.

Intestinal complex. First pair of intestinal diverticula ramified in ramus anterior and ramus coxalis. Second pair of intestinal diverticula ramified in ramus transversalis and ramus longitudinalis. Third pair of intestinal diverticula with two rami - ramus medianus and ramus lateralis. Ramus medianus remarkably shorter than ramus lateralis; ramus lateralis in distal half rectangularly ventrally oriented. First half of the ramus lateralis on the distal end (at the place where it's rectangularly changing orientation to the ventral side) is heavily widened.

Travuniidae Absolon & Kratochvíl, 1932

Abasola hofferi Šilhavý, 1936 Figs 5B-D, 8, 9

Material examined: From Pokljuka Gornja Cave (type locality), near the village of Knežlaz, Krivošije, Montenegro (Serbia & Montenegro), 1.07.1997 leg. I. Karaman: 1 ♂, 1 juv.; *ibid.*, 9.07.1999, leg. S. Ognjenović: 1 ♂; Jama Duboka pothole, *ibid.*, 15.09.2003, leg. S. Ognjenović: 1 juv.

Specimens are deposited in the author's collection at the Department of Biology and Ecology – Novi Sad (Serbia & Montenegro).

Dorsal scutum anteriorly with visible remnants of 2 tubercles (Fig. 8A). The anterior one, more pronounced and coarsely ornamented, is situated on the frontal edge of the dorsal scutum and probably represents the remnant of some larger protrusion. The other one is noticeably smaller and located more posteriorly and thus is presumably the remnant of an ocular tubercle.

* Histological studies of the inner structure of the glans are undertaken by Prof. J. Martens and will be published in due time.

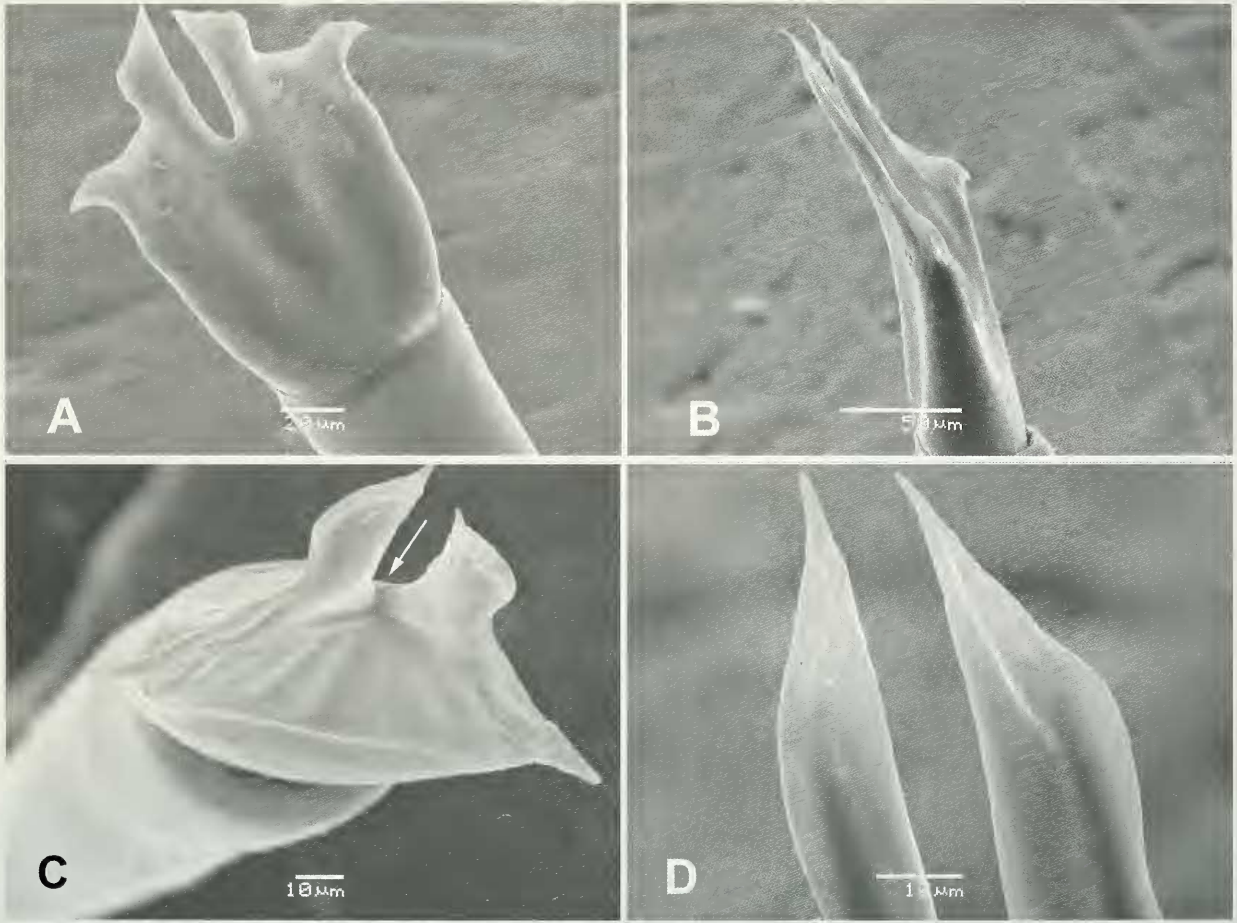

FIG. 6
Trojanella serbica gen. n., sp. n. (male paratype, 1.6 mm), penis: **A**, glans, ventral view; **B**, glans, lateral view; **C**, distal view of glans with seminal opening indicated by arrow; **D**, terminal part of glans bifurcation, dorsal view.

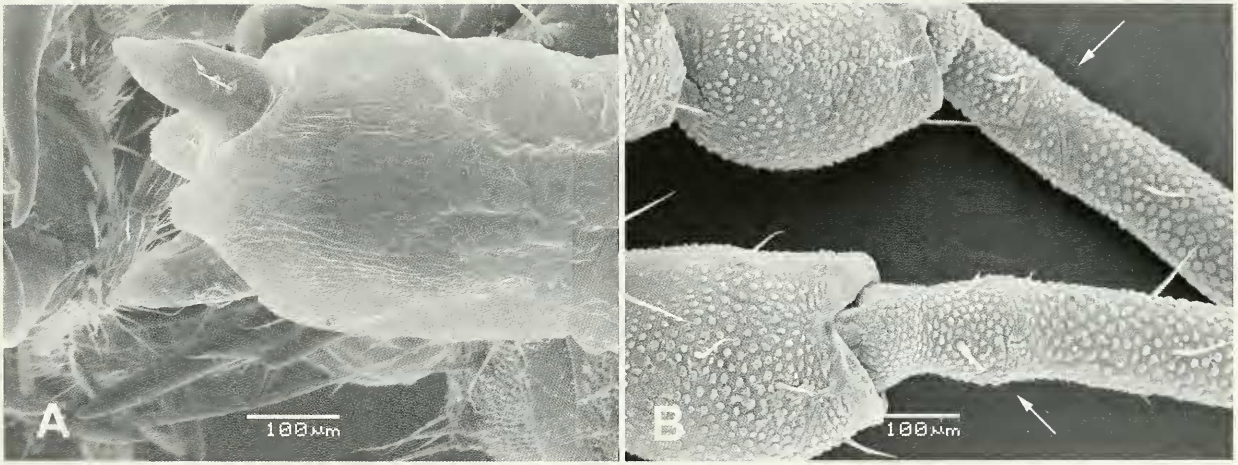

FIG. 7
Trojanella serbica gen. n., sp. n. (female paratype, 1.58 mm): **A**, ovipositor. *T. serbica* gen. n., sp. n. (male paratype, 1.76 mm): **B**, femur with false articulation indicated by arrows.

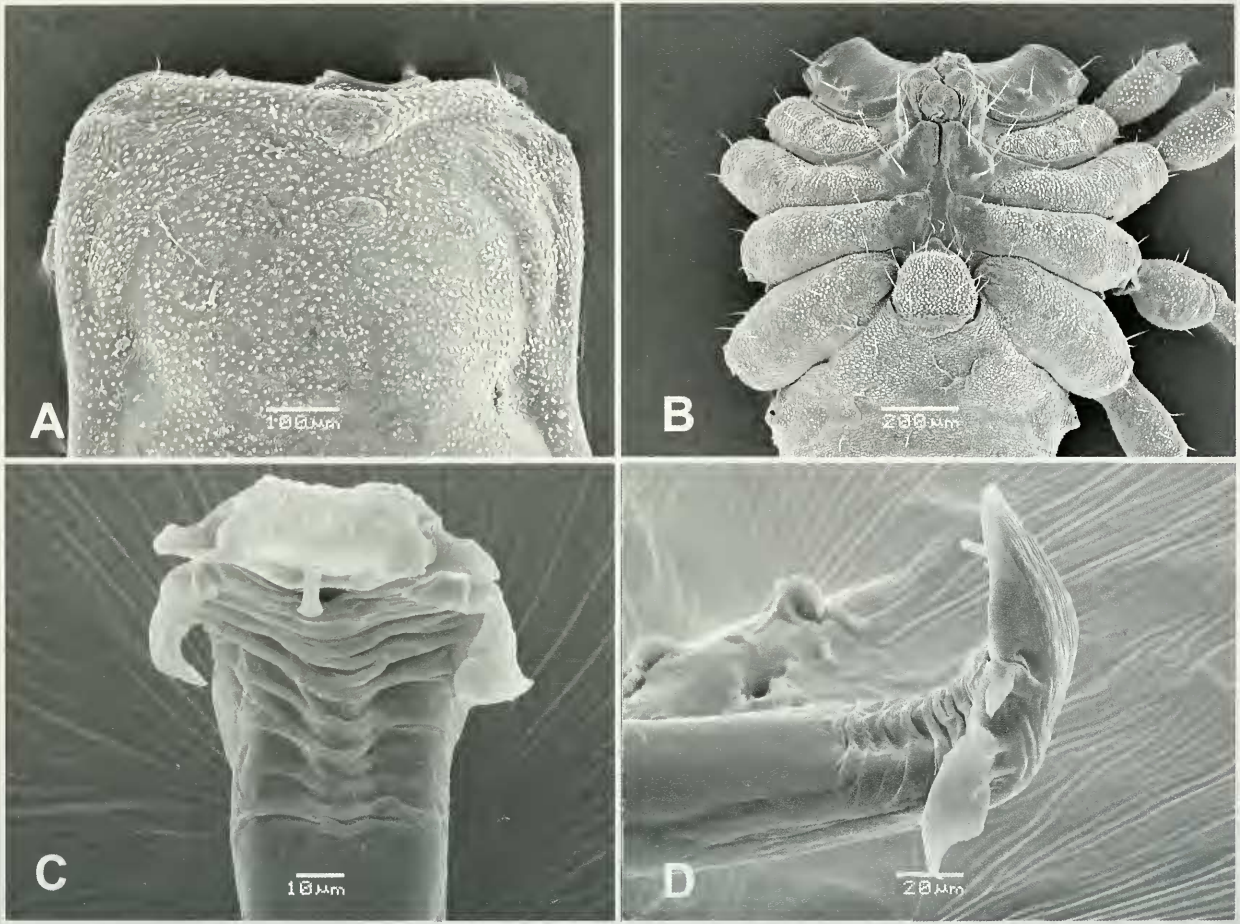

FIG. 8
Abasola hofferi (male, 1.23 mm): **A**, anterior part of dorsal scutum, dorsal view; **B**, anterior part of body, ventral view; **C**, terminal part of penis (contracted), ventral view; **D**, same, lateral view.

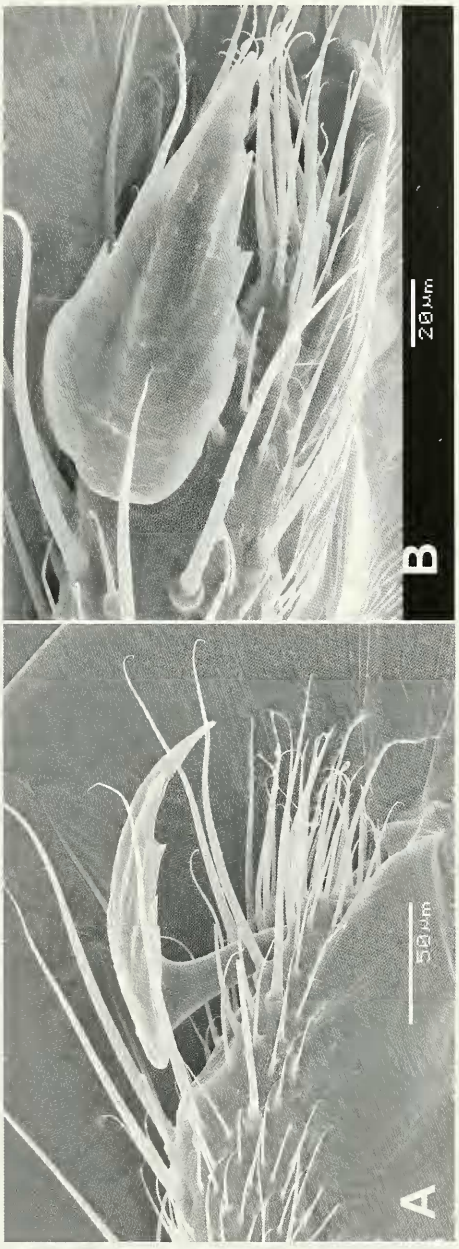

FIG. 9
Abasola hofferi (male, 1.23 mm): **A**, claw IV, lateral view; **B**, claw IV, dorsal view.

Penis structure (Figs 5B-D, 8C-D); truncus stout, basally and terminally narrowed, continuous with glans without clear transition; subterminally with two pairs of lateral membranous wing-like lamina, basal pair bigger and dorsally directed (Fig. 5C); ventral side of glans with a small subterminal stylus; 2 pairs of small spines subterminally, bigger one ventrolaterally above wing-like lamina, smaller one ventrally on both sides of stylus; a muscle in basal 2/3 of truncus.

DISCUSSION

With some details of their structures (primarily of the penis), the species *Trojanella serbica* gen. n., sp. n. and *Abasola hofferi* additionally complicate the already rather confusing classification of Travunioidea. It is difficult to single out any differentiating character used so far that could clearly define a particular family or subfamily of Travunioidea. Claw structure seems not so useful in family and subfamily classification of the Travunioidea, as it was summarised by Hunt & Hickman (1993) for Triaenonychidae. Too much attention was paid to this character and has sometimes caused absurd results. An example are species *Paranonychus brunneus* (Banks, 1911) from the north-west of North America and *Mutsunonychus fuscus* Suzuki, 1976 from the north-east of Japan, which are obviously congeneric. Based solely on claw structure, they were classified into two different subfamilies of the Triaenonychidae: Paranonychinae Briggs, 1971 and Kaolinonychinae Suzuki, 1975, respectively (Briggs, 1971; Suzuki, 1976). Dorsoventrally flattened claws III and IV (with central prong and side branches in the same plane) in *Trojanella serbica* gen. n., sp. n., although of the triaenonychid type, seem closer to the peltonychium type of claws present in *A. hofferi* (i.e. Dinaric travunioids) than to the claws of Triaenonychidae from the southern hemisphere (typical triaenonychid type).

Claw structure cannot be a defining character for the family Travuniidae either, because the obvious great differences in penis structures of Dinaric Travuniidae and the genus *Peltonychia* do not confirm their monophyletic origin. It can be assumed that the closeness by this character is a consequence of independent occurrence of the same, probably convergent neotenic characteristic. The current composition of the Travuniidae is also largely a result of a, in my opinion flawed, perception of Europe as a region with more or less homogeneous fauna. The genus *Trojanella* gen. n., Dinaric travuniids and Balkan Cyphophthalmi (as representatives of the old relictual fauna) suggest that a part of the Balkan fauna must have had a long and significant period of autonomous and independent development, in an isolated region (which surely must have had its own dynamics).

The sternum structure seems still useful in the classification of Travunioidea. Based on this character *Trojanella* gen. n. is close to Triaenonychidae. However, among Dinaric travuniids there are remarkable differences, from a wedge-shaped sternum in *Dinaria vjetrenicae* Hadži, 1932 (Hadži, 1932: fig. 6) to a wider sternum type with subterminal expansion in *A. hofferi*, and an almost Triaenobuninae type sternum in *Abasola borisi* Hadži, 1973 (Hadži, 1973: fig.15c).

The spiracle structure may be a character of importance for classifying Travunioidea. There are significant differences in spiracle structures among species discussed in this paper. *Trojanella serbica* gen. n., sp. n. has unconcealed spiracles,

semicircular in shape, which are present also in south hemisphere Triaenonychinae. In *Abasola hofferi* the spiracles are small, rounded, exposed on a tubercle-like protrusion and laterally directed. This type of spiracle (exposed) is also present in some north hemisphere Travunioidea (Dinaric travuniids; Paranonychinae Briggs, 1971; Kaolinonychinae Suzuki, 1975; Nippononychinae Suzuki, 1975 and *Yuria pulcra* Suzuki, 1964). The concealed type of spiracles is present in south hemispheric Triaenobuninae and some north hemispheric Travunioidea, as well.

The penis structure and musculature are no doubt very important in the classification of this group. Yet, it seems that they have not been used consistently when defining certain taxonomic categories. One of the main differentiating characters of the family Cladonychiidae (Martens, 1978, 1986) is the basal position of penis musculature. However, according to Hadži's description and drawings (Hadži, 1935), the type species of the family, *Cladonychium corii* Hadži, 1935 [synonymized by Briggs (1969) with *Erebomaster acanthina* (Crosby & Bishop, 1924)] has the truncus with a fully developed muscle. Despite this significant deviation, the current composition of the family Cladonychidae, based on the penis structure, maybe is not questioned*. This discrepancy may be assigned to something which appears as a general tendency within the Travunioidea (and wider, within Opiliones) towards simplification of the terminal part of the penis (both structurally and functionally, causing reduction of the musculature) and prolongation of the truncus, followed by glans reduction (with subsequent displacement i.e. concentration of the remaining musculature in the widest, basal part of the truncus). This tendency (and gradual transition), ranging from the complex penis structure in Australian Triaenonychidae to the simple penis in species belonging to the genus *Peltonychia*, can manifest itself in various stages of reduction and changes in closely related taxa, which is considered to be the case with Cladonychidae, as well. It is also possible that cases of convergent similarity with respect to the penis structure may occur among phylogenetically remote taxa. *Trojanella serbica* gen. sp. n. deviates from this tendency because it is obvious that the terminal part of the penis (glans) is functionally very complex and highly apomorphic. The specific structure of the glans may be derived from the complex structure of the terminal part of the penis in Australian and South African triaenonychid taxa shown by Martens (1986) by complete reduction of the dorsal and dorsolateral plates and by merging the stylus with the ventral plate (i.e. "Sensillenträger"). With respect to the penis structure, this species represents an unique and isolated phylogenetic line in the superfamily.

It is interesting that the great heterogeneity of penis structures in Travunioidea is almost invariably followed by the presence of subterminal, laterally diverging structures (obviously functionally very important) of different structural types, from dorsolateral plates in south hemispheric genera to diverging thorns of the glans in the species of the genus *Peltonichya*. In *Trojanella* gen. n. they are present in the form of diverging teeth on the glans.

Penis structure in *A. hofferi* may also be derived from the complex types of Australian and South African triaenonychids. The basal pair of membranous wing-like lateral lamina may represent dorsolateral plates of the terminal part of the truncus,

* But the ovipositor structure in Cladonychidae also shows remarkable differences. A comprehensive revision of this family is needed.

which most triaenonychids have. The part of the penis distally to these structures may be the glans, i.e. the ventral plate and the stylus that have become a glans. The structure of the penis in *D. vjetrenicae* may be derived from the penis structure of *A. hofferi*, the glans of which is greatly reduced and the dorsolateral plates strongly developed and with ventral orientation.

The structure of the intestinal complex could give useful data for phylogenetic consideration, however there are available data only for a few species (Dumitrescu 1974, 1976). Dumitrescu (1976) noticed differences in midgut anatomy between southern hemispheric and northern hemispheric Travunioidea. After him southern hemispheric Travunioidea posses the ramus exterior of the third pair of intestinal diverticula in comparison with species on the northern hemisphere. In *Trojanella serbica* gen. n., sp. n. absence of the ramus exterior is evident, but a widened median part of ramus lateralis could be interpreted as shortened and reduced "true ramus lateralis". In such interpretation the part distally of that widening could represent ramus exterior. In that case the midgut anatomy of *T. serbica* gen. n., sp. n., could represent a transition form between "southern" and "northern" type of the intestinal complex. To make final conclusions about taxonomic value and usefulness of the intestinal structure in solving problems in Travunioidea, details of this structure in higher number of species are needed.

Unfortunately I was not able to investigate completely the intestinal structure of *A. hofferi*.

Significant differences in the penis structure of *Abasola hofferi* and *Dinaria vjetrenicae* suggest that a diverse travuniid fauna (at least two genera and obviously more than two species) exists in one relatively small Dinaric region (south-eastern Herzegovina, southern Dalmatia and south-western Montenegro). So far six species in three genera – *Travunia*, *Abasola* and *Dinaria* – have been described, at times extremely superficially and uncritically (without any clear differentiating characteristics given for the genera). In at least two cases the descriptions are based on juvenile specimens. The confusing situation is additionally complicated by imprecise location data for some caves where certain species were recorded, and by unknown destiny of some specimens. In order to get a clearer picture of this undoubtedly distinct phyletic line of Travunioidea, it is necessary to obtain detailed information on the morphology of all the species described so far. Unfortunately this will be difficult in some cases. The terrain where the Durović pećina cave [type locality of *Abasola troglodytes* (Roewer,1915)] is situated has been devastated and made part of an airport complex (R. Ozimec in pers. comm.), while the Dejanova pećina cave (type locality of *Abasola borisi* Hadži, 1973) is now submerged in an artificial lake.

Once the Dinaric travuniids have been revised, the species *Dinaria vjetrenicae* and *Abasola hofferi* may no longer be placed in to the genera where they currently are.

Laniatorid *Paralola buresi* Kratochvíl,1951 inhabits the same regions as *T. serbica* gen. n., sp. n.(western part of Mt Stara Planina), and *Lola insularis* Kratochvíl, 1937 (both in the Phalangodoidea-Phalangodidae) is found in the south Dinaric region, like Dinaric travuniids. After comparing characteristics of the species *Trojanella serbica* gen. n., sp. n. and *Abasola hofferi* (as representatives of Dinaric travuniids) it is clear that both are phylogenetically very distant from each other. It would be inte-

resting to research further into interrelations and phylogenetical distance of the genera *Paralola* and *Lola* (Phalangodidae) for the purpose of comparison.

ACKNOWLEDGEMENTS

I thank biospeleologist Siniša Ognjenović who has collected the first specimens of *Trojanella serbica* gen. sp. n.. Phil Sirvid, Nobuo Tsurusaki, Graham Milledge, Jürgen Gruber and Mark Harvey have provided the necessary literature. Momčilo Popović has made the nice drawing of *T. serbica* gen. n., sp. n. Miša Bokorov produced the SEMs. Roman Ozimec shared information on the type locality of *Abasola troglodytes*. Jürgen Gruber, Peter Schwendinger, Darrell Ubick and Jochen Martens critically commented on an earlier version of this manuscript. I am grateful to them all.

REFERENCES

Briggs, T.S. 1969. A new Holarctic family of laniatorid phalangids. *The Pan-Pacific Entomologist* 45: 35-50.

Briggs, T.S. 1971. The harvestmen of family Triaenonychidae in North America (Opiliones). *Occasional Papers of the California Academy of Sciences* 90: 1-43.

Dumitrescu, D. 1974. Contribution à l'étude de l'appareil digestif (intestin moyen) des Opilions (Arachnida). *Travaux du Muséum d'Histoire Naturelle "Grigore Antipa"* 14: 95-107.

Dumitrescu, D. 1976. Recherches morphologiques sur l'appareil digestif (intestin moyen) des Gonyleptomorphi (Arachnida, Opilionida). *Travaux du Muséum d'Histoire Naturelle "Grigore Antipa"* 17: 17-30.

Hadži, J. 1932. Prilog poznavanju pećinske faune Vjetrenice (in serbian cirilic). *Glas Srpske Kraljevske akademije* 151: 102-157.

Hadži, J. 1935. Ein eigentümlicher neuer Höhlen-Opilionid aus Nord-Amerika, *Cladonychium corii* g. n. sp. n. *Biologia Generalis* 11: 49-72.

Hadži, J. 1973. Novi taksoni suhih južin (Opilionidea) v Jugoslaviji. *Razprave, Classis IV, Historia Naturalis et Medicina*, SAZU, Ljubljana, 16: 1-120.

Hunt, G.S & Hickman, J.L. 1993. A revision of the Genus *Lomanella* Pocock and its implifications for family level classification in the Travunioidea (Arachnida: Opiliones: Triaenonychidae). *Records of the Australian Museum* 45: 81-119.

Martens J. 1978. Spinnentiere, Arachnida, Weberknechte, Opiliones. *Die Tierwelt Deutschlands*, Gustav Fischer, Jena, 64:1-449.

Martens J. 1986. Die Grossgliederung der Opiliones und die Evolution der Ordnung (Arachnida)(pp. 289-310). *In*: Barrientos, J. A.(ed.). Actas 10 Congreso International de Aracnologia, Jaca/España, Septiembre 1986, vol. 1. *Instituto Pirenaico de Ecologia & Grupo de Aracnologia, Barcelona*, X + 428 pp.

Suzuki, S. 1976. Two triaenonychid harvestmen from the northeast, Japan (Triaenonychidae, Opiliones, Arachnida). *Journal of Science of the Hiroshima University* B, 26: 177-185.

Šilhavý, V. 1936. Nový jeskynni sekač z Jugoslavie, *Abasola hofferi* n.sp. *Sbornik entomologického oddeleni Národního Musea v Praze*, 14: 208-213.